

Chapter 7 Homework

1. Read the following abstract from an article recently published in *Nature*. Briefly explain how the steps the authors took correspond to the steps of the scientific method. All five steps are represented here.

Letter: An unexpected cooling effect in Saturn's upper atmosphere
C. G. A. Smith, A. D. Aylward, G. H. Millward, S. Miller and L. E. Moore
<http://www.nature.com/nature/journal/v445/n7126/abs/nature05518.html>

The upper atmospheres of the four Solar System giant planets exhibit high temperatures that cannot be explained by the absorption of sunlight. In the case of Saturn the temperatures predicted by models of solar heating are 200 K, compared to temperatures of 400 K observed independently in the polar regions and at 30° latitude. This unexplained 'energy crisis' represents a major gap in our understanding of these planets' atmospheres. An important candidate for the source of the missing energy is the magnetosphere, which injects energy mostly in the polar regions of the planet. This polar energy input is believed to be sufficient to explain the observed temperatures, provided that it is efficiently redistributed globally by winds, a process that is not well understood. Here we show, using a numerical model, that the net effect of the winds driven by the polar energy inputs is not to heat but to cool the low-latitude thermosphere. This surprising result allows us to rule out known polar energy inputs as the solution to the energy crisis at Saturn. There is either an unknown—and large—source of polar energy, or, more probably, some other process heats low latitudes directly.

2. Compare and contrast the first steps in the engineering and scientific methods. Why are these differences important?

3. Directions: After each description of health news just released in 2004, identify whether you think it would be better labeled as science or engineering, then briefly describe what characteristics of the example support your choice.

a. Laboratory Rat Gene Sequencing Completed; Humans Share One-fourth Of Genes with Rat, Mouse

A large team of researchers, including a computer scientist at Washington University in St. Louis, has effectively completed the genome sequence of the common laboratory brown rat, *Rattus norvegicus*. This will make the third mammal to be sequenced, following the human and mouse.

<http://record.wustl.edu/news/page/normal/3222.html>

b. Chemists Seek Light-activated Glue For Vascular Repair

Surgeons battle time and the body's defenses as they stitch together veins and arteries, whether after an injury or in the course of such treatments as transplants or bypasses. Loss of blood before a site is closed and too much clotting soon after challenge medical care. Virginia Tech researchers are creating biocompatible adhesives for use with vascular tissue that will speed the process of mending tissue.

<http://www.news-medical.net/?id=216>

c. New Biomaterial May Replace Arteries, Knee Cartilage

A unique biomaterial developed by researchers at the Georgia Institute of Technology could be available in as few as five years for patients needing artery or knee cartilage replacement. It may also be used to speed repair of damaged nerves in patients with spinal cord injuries and as the basis for an implantable drug delivery system.

<http://gtresearchnews.gatech.edu/newsrelease/BIOMAT.html>

d. New Insight on Cell Growth Could Lead To Method for Stopping Cancer

WEST LAFAYETTE, Ind. – Halting the development of certain pancreatic, ovarian, colon and lung cancers may be possible with therapy based on recent Purdue University research. By investigating a single molecule that influences cell growth, a research group in the Purdue Cancer Center, has gained new insight into the chain of events that make some cancer cells divide uncontrollably – insight that may eventually lead to a way to break that chain, stopping cancer in its tracks.

<http://www.purdue.edu/UNS/html4ever/2004/040328.Henriksen.ras.html>

4. Identify a researcher involved in developing new health technologies at your institution. Arrange to interview them in person. Write a one page profile of this individual. Your profile should include at least the following:
- A summary of the researcher's educational background
 - A description of current technologies they are developing and the potential of these technologies to improve health
 - Your assessment of how where their research and development efforts fits along the spectrum of translational research